## REMARKS

The present Amendment supplements the minor modifications in the Preliminary Amendment as set forth at the filing of the application to reflect the amendments made under Article 34 in the PCT Application.

The amendment to the specification is supported from Page 8, Line 27 to Page 9, Line 5 to correct a minor typographical error.

The new dependent Claims 29-38 are supported both in the specification and the previous claims as can be seen in the definition of the first embodiment set forth in "2-1. Manufacture of Front Panel," starting on Page 19 of our specification. Thus, our specification and Claim 5 defines that a first crystal can be a magnesium oxide crystal while in the specification on Pages 3, Lines 5-7 the manner of obtaining this crystal is set forth.

With regards to Claim 30, a thin film technique is disclosed also on Page 3, Line 5.

For Claim 33, support can be found starting on Page 20, Line 27 through Page 21, Line 3.

Finally, the fact that a second crystal material can be a combination of materials and the first crystal material can be selected from one or more members of a group of suitable materials can be found on Page 20, Lines 4-13.

The references cited in the International Search Report are believed to be of record in the application.

Additionally, Japanese Laid-Open Application No. 09-92133 was discussed on Page 2 of our Description of Related Art, while Japanese Laid-Open Application No. 04-10330 was discussed on Page 3 of our specification.

Copies of these references along with the English Abstract are included to complement the description in English in our specification.

Finally, Japanese Laid-Open Patent Application No. JP9-167566 is attached hereto along with an English translation. It is requested that these references be reviewed and made of record.

If there are any questions with regards to this amendment, the undersigned attorney would appreciate a telephone conference.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on August 23, 2006.

By: Sharon Farnus

Sharon Farnus

Signature

Dated: August 23, 2006

Very truly yours,

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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-167566

(43)Date of publication of application : 24.06.1997

(51)Int.Cl. H01J 11/02
H01J 9/02

(21)Application number : 07-327236

(22)Date of filing : 15.12.1995

(71)Applicant : FUJITSU LTD

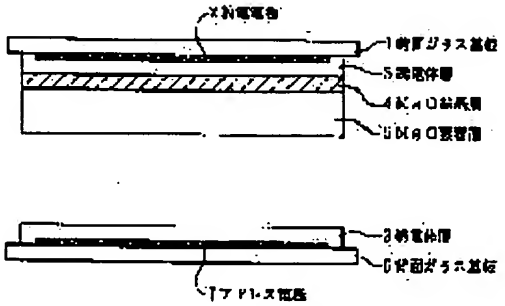
(72)Inventor : HIDAKA SOICHIRO
IWASE NOBUHIRO
TADAKI SHINJI

## (54) PLASMA DISPLAY PANEL AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a PDP (plasma display panel) provided with a protection layer of a dielectric layer capable of lowering a discharge start voltage and improving a spattering resistance regarding improvement of the dielectric layer of an AC type PDP and its manufacture.

SOLUTION: This PDP covers a discharge electrode 2 formed on a front face glass board 1 with a dielectric layer 3 and is provided with a protection layer on this dielectric layer 3. And, this protection layer is constituted so as to be made of a laminated-layer structural body of a MgO crystal layer 4 and a MgO evaporation layer 5, and manufacture of this PDP is constituted so as to include a process for forming the MgO evaporation layer 5 on the surface of this MgO crystal layer 4 following ion-cleaning the surface of this MgO crystal layer 4 after the MgO crystal layer 4 is formed on the surface of this dielectric layer 3 when the protection layer is formed.



LEGAL STATUS

[Date of request for examination] 29.01.2002

| | |
|---|---|
| [Date of sending the examiner's decision of rejection] | |
| [Kind of final disposal of application other than the examiner's decision of rejection or application converted registration] | |
| [Date of final disposal for application] | |
| [Patent number] | 3677571 |
| [Date of registration] | 20.05.2005 |
| [Number of appeal against examiner's decision of rejection] | |
| [Date of requesting appeal against examiner's decision of rejection] | |
| [Date of extinction of right] | |

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CLAIMS

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[Claim(s)]
[Claim 1] The plasma display panel with which said protective layer is characterized by consisting of the laminating structure of a MgO crystal layer and a MgO vacuum evaporationo layer in the plasma display panel which covered with the dielectric layer the discharge electrode formed on the substrate, and was equipped with the protective layer on this dielectric layer.
[Claim 2] The plasma display panel according to claim 1 with which said MgO crystal layer is characterized by consisting of complex of MgO impalpable powder, magnesium impalpable powder, the organic-acid metal salts of magnesium, or these members.
[Claim 3] The plasma display panel characterized by a MgO crystal layer according to claim 2 containing low melting glass further.
[Claim 4] The manufacture approach of the plasma display panel characterized by including the process which forms a MgO vacuum evaporationo layer in the MgO crystal layer front face concerned after carrying out ion cleaning of the front face of this MgO crystal layer after facing forming a protective layer according to claim 1 and forming a MgO crystal layer in the front face of said dielectric layer.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to amelioration of the protective layer of the dielectric layer of AC mold plasma display panel (it is hereafter called PDP for short).
[0002] With colorization of PDP in recent years, the AC mold PDP comes to be used as a full color indicating equipment of a television set, and attracts attention as a large-sized flat display for Hi-Vision images especially.
[0003] In order to use for such an application, highly-minute-izing and reinforcement are required with enlargement of PDP. From the above situations, PDP large-sized and highly minute, and long lasting is demanded.
[0004]
[Description of the Prior Art] Drawing 4 explains the conventional PDP to a detail. Drawing 4 is drawing showing the principal part of the conventional PDP.
[0005] The principal part of the conventional PDP is 50 micrometers of thickness which becomes two or more pairs of two parallel discharge electrodes 12 for a display which adjoin the front face of the front-windshield substrate 11 of 3mm of board thickness which consists of soda lime glass, and serve as a pair as shown in drawing 4 from the low melting glass which covers this discharge electrode 12. The MgO layer 15 of 10,000A of thickness used as a protective coat is formed in the front face of a dielectric layer 13 and this dielectric layer 13.
[0006] As the formation approach of this MgO layer 15, although vacuum deposition is generally used, a spray method or the applying method using a liquid-like organic-acid metal salt as the other approaches, and the impalpable powder applying method which applies the paste containing MgO impalpable powder are also used.
[0007] On the other hand, the address electrode 17 and the band-like septum (not shown) of each other which demarcates the discharge section are formed in the front face of the tooth-back glass substrate 16 of 3mm of board thickness which consists of soda lime glass in parallel. In this front-windshield substrate 11, after making an electrode forming face counter and piling up, the closure of that perimeter was carried out, and after exhausting the inside of the discharge space formed among these substrates, the mixed gas of 99.9% of neon (Ne) and the xenon (Xe) of 0.1 % is enclosed as gas for discharge.
[0008]
[Problem(s) to be Solved by the Invention] In the conventional AC mold PDP explained above, a protective layer is prepared from the need of raising spatter-proof nature so that a secondary-emission ratio gamma may be enlarged, and reducing breakdown voltage and a life may be lengthened, and generally the MgO vacuum evaporationo layer is used as this protective layer. Since the dielectric film of a substrate is low melting glass when this protective layer is formed with vacuum deposition, first, the amorphous layer of 1000A of thickness numbers is formed, and a crystal layer is formed gradually after that. However, there was a trouble of having become higher than the driver voltage which driver voltage goes up rapidly and is set up if the spatter of this crystal layer will be carried out if the time of PDP

becomes long, thickness becomes thin and a spatter reaches an amorphous layer, and becoming the life of PDP.
[0009] In the liquid-like the spray methods or the applying methods using an organic-acid metal salt other than vacuum deposition, the trouble that an opening was generated was in the formed protective layer in the impalpable powder applying method which applies the paste which can form only the protective layer of about 2,000-3,000A thickness, and contains MgO impalpable powder at one process.
[0010] This invention aims at offer of PDP possessing the protective layer of the dielectric layer it becomes possible whose to reduce breakdown voltage and to raise spatter-proof nature, and its manufacture approach from the above situations.
[0011]
[Means for Solving the Problem] PDP of this invention is constituted so that the protective layer which consists of a layered product of a MgO crystal layer and a MgO vacuum evaporationo layer may be provided.
[0012] In this invention, since it becomes possible to be able to thicken the MgO crystal layer of the front face of a dielectric layer, and to also raise crystallinity, since a MgO crystal layer is formed in the lower layer of the MgO layer by vacuum evaporationo using MgO impalpable powder or the organic-acid metal salt containing MgO, the thing with good spatter-proof nature for which long lasting PDP is offered becomes possible.
[0013]
[Embodiment of the Invention] Drawing 1 - drawing 3 explain the example of this invention to a detail below. Drawing in which drawing 1 shows the principal part of PDP of this invention, drawing in which drawing 2 shows the example of the manufacture approach of PDP of this invention in order of a process, and drawing 3 are drawings showing the relation between the test time of PDP of this invention, and the variation of discharge voltage.
[0014] PDP of this invention is 50 micrometers of thickness which becomes the front face of the front-windshield substrate 1 of 3mm of board thickness which consists of soda lime glass from a discharge electrode 2 and low melting glass like the conventional example as shown in drawing 1. The dielectric layer 3 is formed.
[0015] Thickness formed in the front face of this dielectric layer 3 by screen printing and heating sintering according to the description of this invention Thickness formed in the front face of the 2,000A MgO crystal layer 4 and this MgO crystal layer 4 with vacuum deposition The protective layer of the two-layer structure which consists of a 8,000A MgO vacuum evaporationo layer 5 is formed.
[0016] On the other hand, the address electrode 7 and the band-like septum (not shown) of each other which demarcates the discharge section are formed in the front face of the tooth-back glass substrate 6 of 3mm of board thickness which consists of soda lime glass in parallel. After making an electrode forming face counter this front-windshield substrate 1 and putting on it, the closure of that perimeter was carried out, and after exhausting the inside of the discharge space formed among these substrates, the mixed gas of 99.9% of neon (Ne) and the xenon (Xe) of 0.1 % is enclosed as gas for discharge.
[0017] such the 1- of PDP -- drawing 2 explains the 5th manufacture approach to a detail in order of a process. the 1- although the formation processes of a MgO crystal layer differ in the 5th manufacture approach, since other production processes are the same, they explain the 1st manufacture approach to a detail.
[0018] It is drawing 2 (a) first. 50 micrometers of thickness which forms a discharge electrode 2 in the front face of the front-windshield substrate 1, and covers this front-windshield substrate 1 and discharge electrode 2 so that it may be shown It sinters at 500 degree C after applying the MgO impalpable powder crystallized on the front face of this dielectric layer 3 after forming a dielectric layer 3 with screen printing and drying, and is thickness. The 2,000A MgO crystal layer 4 is formed.
[0019] Next, drawing 2 (b) Thickness forms in the front face of this MgO crystal layer 4 the MgO vacuum evaporationo layer 5 which is 8,000A with vacuum deposition so that it may be shown. Then, as shown in drawing 1 , the perimeter of the tooth-back glass substrate 6 of 3mm of board thickness which consists of soda lime glass with which the address electrode 7 is formed, and the perimeter of this front-

windshield substrate 1 are closed, the air in the discharge space between these front-windshield substrates 1 and tooth-back glass substrates 6 is exhausted, and the mixed gas of 99.9% of neon (Ne) and the xenon (Xe) of 0.1 % is enclosed as gas for discharge.
[0020] After applying the paste of organic-acid metal salts, such as magnesium acetate and propionic-acid magnesium, with screen printing instead of the screen printing of the crystallized MgO impalpable powder which is performed in the 1st manufacture approach and drying in the 2nd manufacture approach of PDP It sinters at 500 degrees C and is thickness. The 2,000A MgO crystal layer 4 is formed.

[0021] After applying the mixed paste of organic-acid metal salts, such as magnesium acetate and propionic-acid magnesium, and the crystallized MgO impalpable powder with screen printing and drying in the 3rd manufacture approach of PDP instead of the screen printing of the crystallized MgO impalpable powder which is performed in the 1st manufacture approach It sinters at 500 degrees C and is thickness. The 2,000A MgO crystal layer 4 is formed.
[0022] After applying the crystallized mixed paste of MgO impalpable powder and low melting glass with screen printing and drying in the 4th manufacture approach of PDP instead of the screen printing of the crystallized MgO impalpable powder which is performed in the 1st manufacture approach It sinters at 500 degrees C and is thickness. The 2,000A MgO crystal layer 4 is formed.
[0023] In the 5th manufacture approach of PDP, the MgO crystal layer 4 is formed in the 1st above-mentioned manufacture approach, and cleaning is performed for about 5 minutes from the ion gun before vacuum evaporationo. these the 1- the relation of the test time of PDP and the variation of discharge voltage which were manufactured by the 5th manufacture approach is shown in drawing 3 .
[0024] As shown in drawing 3 , test time the variation of the discharge voltage of the conventional PDP Although it hardly changes to the variation of the discharge voltage of each example of this invention even for about 1,000 hours, if it becomes in about 1,200 hours, it will become remarkably large and the effectiveness of this invention will become clear.
[0025] If each example of this invention is compared, there is least variation of the discharge voltage of an example 3, there is little variation of the discharge voltage of the example 5 carried out to the example 1 by adding an ion cleaning process next, and, subsequently to the order of an example 4, an example 1, and an example 2, the variation of discharge voltage has increased.
[0026] In addition, it cannot be overemphasized that this invention is applicable not only to the above-mentioned 3 electrode-surface discharge mold ACPDP but ACPDP of the field discharge mold which has two electrodes, or an opposite discharge mold.
[0027]
[Effect of the Invention] Since according to this invention the MgO crystal layer of the front face of a dielectric layer can be thickened, and it can become possible to also raise crystallinity and spatter-proof nature can be raised so that clearly from the above explanation, there is an advantage which becomes possible [ manufacturing long lasting PDP ], and offer of economical [ remarkable ] and remarkable PDP which can expect the effectiveness of the improvement in dependability, and its manufacture approach is possible.

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[Translation done.]

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TECHNICAL FIELD

---

[Field of the Invention] This invention relates to amelioration of the protective layer of the dielectric layer of AC mold plasma display panel (it is hereafter called PDP for short).
[0002] With colorization of PDP in recent years, the AC mold PDP comes to be used as a full color indicating equipment of a television set, and attracts attention as a large-sized flat display for Hi-Vision images especially.
[0003] In order to use for such an application, highly-minute-izing and reinforcement are required with enlargement of PDP. From the above situations, PDP large-sized and highly minute, and long lasting is demanded.

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PRIOR ART

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[0005] The principal part of the conventional PDP is 50 micrometers of thickness which becomes two or more pairs of two parallel discharge electrodes 12 for a display which adjoin the front face of the front-windshield substrate 11 of 3mm of board thickness which consists of soda lime glass, and serve as a pair as shown in drawing 4 from the low melting glass which covers this discharge electrode 12. The MgO layer 15 of 10,000A of thickness used as a protective coat is formed in the front face of a dielectric layer 13 and this dielectric layer 13.
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EFFECT OF THE INVENTION

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[Effect of the Invention] Since according to this invention the MgO crystal layer of the front face of a dielectric layer can be thickened, and it can become possible to also raise crystallinity and spatter-proof nature can be raised so that clearly from the above explanation, there is an advantage which becomes possible [ manufacturing long lasting PDP ], and offer of economical [ remarkable ] and remarkable PDP which can expect the effectiveness of the improvement in dependability, and its manufacture approach is possible.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] In the conventional AC mold PDP explained above, a protective layer is prepared from the need of raising spatter-proof nature so that a secondary-emission ratio gamma may be enlarged, and reducing breakdown voltage and a life may be lengthened, and generally the MgO vacuum evaporationo layer is used as this protective layer. Since the dielectric film of a substrate is low melting glass when this protective layer is formed with vacuum deposition, first, the amorphous layer of 1000A of thickness numbers is formed, and a crystal layer is formed gradually after that. However, there was a trouble of having become higher than the driver voltage which driver voltage goes up rapidly and is set up if the spatter of this crystal layer will be carried out if the time of PDP becomes long, thickness becomes thin and a spatter reaches an amorphous layer, and becoming the life of PDP.
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MEANS

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[0013]
[Embodiment of the Invention] Drawing 1 - drawing 3 explain the example of this invention to a detail below. Drawing in which drawing 1 shows the principal part of PDP of this invention, drawing in which drawing 2 shows the example of the manufacture approach of PDP of this invention in order of a process, and drawing 3 are drawings showing the relation between the test time of PDP of this invention, and the variation of discharge voltage.
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vacuum evaporationo layer 5 which is 8,000A with vacuum deposition so that it may be shown. Then, as shown in drawing 1 , the perimeter of the tooth-back glass substrate 6 of 3mm of board thickness which consists of soda lime glass with which the address electrode 7 is formed, and the perimeter of this front-windshield substrate 1 are closed, the air in the discharge space between these front-windshield substrates 1 and tooth-back glass substrates 6 is exhausted, and the mixed gas of 99.9% of neon (Ne) and the xenon (Xe) of 0.1 % is enclosed as gas for discharge.
[0020] After applying the paste of organic-acid metal salts, such as magnesium acetate and propionic-acid magnesium, with screen printing instead of the screen printing of the crystallized MgO impalpable powder which is performed in the 1st manufacture approach and drying in the 2nd manufacture approach of PDP It sinters at 500 degrees C and is thickness. The 2,000A MgO crystal layer 4 is formed.

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[0024] As shown in drawing 3 , test time the variation of the discharge voltage of the conventional PDP Although it hardly changes to the variation of the discharge voltage of each example of this invention even for about 1,000 hours, if it becomes in about 1,200 hours, it will become remarkably large and the effectiveness of this invention will become clear.
[0025] If each example of this invention is compared, there is least variation of the discharge voltage of an example 3, there is little variation of the discharge voltage of the example 5 carried out to the example 1 by adding an ion cleaning process next, and, subsequently to the order of an example 4, an example 1, and an example 2, the variation of discharge voltage has increased.
[0026] In addition, it cannot be overemphasized that this invention is applicable not only to the above-mentioned 3 electrode-surface discharge mold ACPDP but ACPDP of the field discharge mold which has two electrodes, or an opposite discharge mold.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] Drawing showing the principal part of PDP of this invention
[Drawing 2] Drawing showing the example of the manufacture approach of PDP of this invention in order of a process
[Drawing 3] Drawing showing the relation between the test time of PDP of this invention, and the variation of discharge voltage
[Drawing 4] Drawing showing the principal part of the conventional PDP
[Description of Notations]
1 Front-Windshield Substrate
2 Discharge Electrode
3 Dielectric Layer
4 MgO Crystal Layer
5 MgO Vacuum Evaporationo Layer
6 Tooth-Back Glass Substrate
7 Address Electrode

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DRAWINGS

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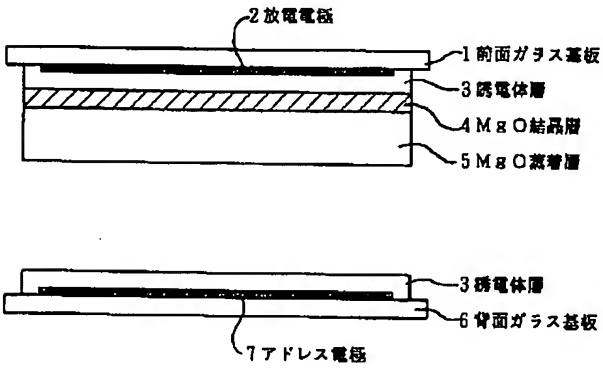
[Drawing 1]

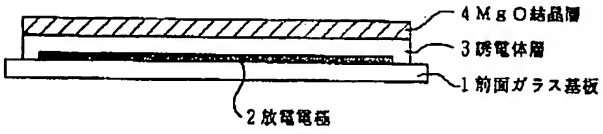
本発明のＰＤＰの主要部を示す図



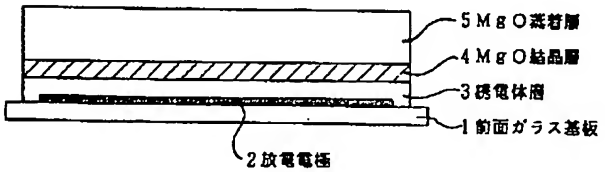

[Drawing 2]

本発明のＰＤＰの製造方法の実施例を工程順に示す図

(a) ＭｇＯ結晶層(4) の形成

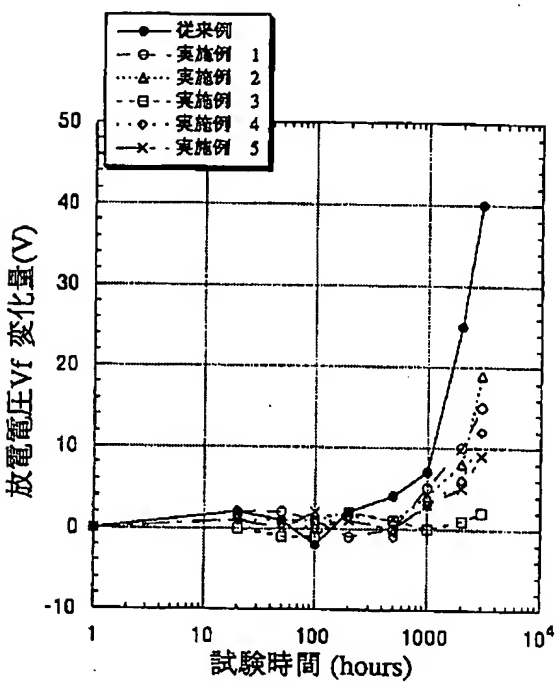



(b) ＭｇＯ蒸着層(5) の形成



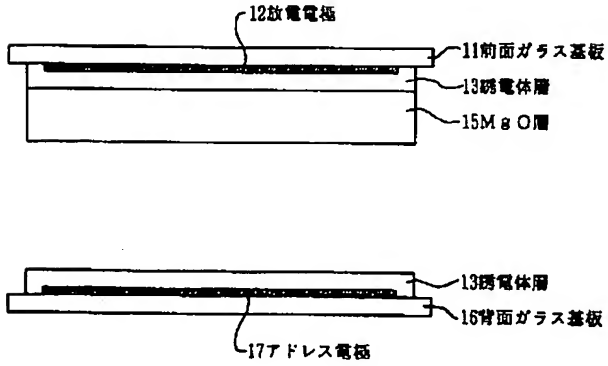

[Drawing 3]

本発明のＰＤＰの試験時間と放電電圧の変化量との関係を示す図




[Drawing 4]

従来のＰＤＰの主要部を示す図

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[Translation done.]